

U.S. Patent Application Serial No. 10/665,204
Response filed December 22, 2004
Reply to OA dated September 22, 2004

REMARKS

Claims 17, 19 and 23 have been amended in order to more particularly point out, and distinctly claim the subject matter to which the applicants regard as their invention. It is believed that this Amendment is fully responsive to the Office Action dated September 22, 2004.

Claims 1 - 23 are currently pending in this patent application, claims 1, 16, 17 and 23 being independent claims.

At the outset, the applicant thanks the Examiner for indicating that claims 1 - 16 have been allowed.^{1/}

As to the merits of this case, the remaining claims 17 - 23 have been rejected as follows:

(1) claims 17 - 21 stand rejected under 35 USC §103(a) based on Kim (U.S. Patent No. 6,664,573) in view of Kusakabe (U.S. Patent No. 5,569,942);

(2) claim 22 stands rejected under 35 USC §103(a) based on Kim in view of Kusakabe, and further in view of Matsuda (U.S. Patent No. 6,525,347); and

(3) claim 23 stands rejected under 35 USC §103(a) based on Kim in view of Kusakabe.

^{1/} See, item 5, page 5 of the outstanding Action.

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The applicants' claimed semiconductor light-receiving device, as now set forth in each of independent claims 17 and 23, clearly includes a unique and distinguishable claimed structural arrangement in which the high-concentration semiconductor intermediate tunneling layer allows electrons to go through this layer to the buffer layer by virtue of the tunnel effect, whereby the high-frequency response characteristics and the high-input saturation characteristics of the photodiode can be improved.

In contrast, the primary references Kim fails to teach or suggest a semiconductor intermediate layer "having a higher impurity concentration than the buffer layer," as acknowledged by the Examiner.^{1/}

As to the secondary reference, Kusakabe, the intermediate layer 104 taught therein is not provided between the buffer layer and the light absorbing layer and is not the tunneling layer. Kusakabe teaches a layer structure having the substrate 101, on which laminated are the buffer layer, the light absorbing layer 103, the intermediate layer 104, the multiplication layer 105 and the window layer 106 in this order. The applicants respectfully note and refer to the description of Kusakabe given in column 2, lines 8 - 15. The intermediate layer 104 of Kusakabe makes the

^{2/} See, lines 8 - 11, page 2 of the outstanding Action.

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discontinuity between the valence band. More particularly, Kusakabe's Figure 4, the intermediate layer 104 accelerates holes moving towards the electrodes 113. The intermediate layer 104 does not employ the tunnel effect at all. This is also evidenced by the impurity concentration of the intermediate layer 104 taught by Kusakabe. Kasukabe's intermediate layer 104 is as low as 3×10^{15} to $1 \times 10^{16} \text{ cm}^{-3}$. This allows the intermediate layer 104 to be sufficiently depleted with the electric field being applied in order to accelerate the movement of holes. It is known by those skilled in the art that such a low concentration taught by Kusakabe does not bring about tunneling.

In contrast, the high-impurity semiconductor intermediate tunneling layer has an impurity concentration, which is, for example, as high as $2 \times 10^{18} \text{ cm}^{-3}$, as described in lines 21 and 22, page 10 of the applicants' specification, as originally filed. It is to be noted that the impurity concentration of the claimed invention is two digits higher than that of the intermediate layer 104 of Kusakabe.

Consequently, the claimed invention would not have been made by a person of ordinary skill in the art by applying the teachings of Kusakabe to those of Kim. As such, even if, *arguendo*, the teachings of Kasukabe can be combined with the teachings of Kim, such combined teachings would still fall far short in fully meeting the applicants' claimed invention, as now set forth in independent claim 17 (and claims 18 - 21, which depend therefrom) and independent

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claim 23. Thus, a person of ordinary skill in the art would not have found the applicants' claimed invention obvious under 35 USC §103(a) based on Kim and Kusakabe, singly or in combination.

Accordingly, the withdrawal of the outstanding obviousness rejection under 35 USC §103(a) based on Kim (U.S. Patent No. 6,664,573) in view of Kusakabe (U.S. Patent No. 5,569,942) is in order, and is therefore respectfully solicited.

As to the other secondary reference of Matsuda, such reference is narrowly relied upon for teaching "a semiconductor optical waveguide path that is formed on the semi-insulating substrate and guides light to the light absorption layer."^{1/} However, such teachings of Matsuda does not supplement the above-discussed deficiencies in the teachings of Kim and Kasukabe in failing to teach the claimed invention, as now set forth in claim 17 from which claim 22 depends.

Accordingly, the withdrawal of the outstanding obviousness rejection under 35 USC §103(a) based on Kim in view of Kusakabe, and further in view of Matsuda (U.S. Patent No. 6,525,347) is in order, and is therefore respectfully solicited.

In view of the aforementioned amendments and accompanying remarks, claims, as

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amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper to Deposit Account No. 01-2340.

Respectfully submitted,
ARMSTRONG, KRATZ, QUINTOS,
HANSON & BROOKS, LLP



Mel R. Quintos

Attorney for Applicants
Reg. No. 31,898

MRQ/lrj/ipc
Atty. Docket No. **031188**
1725 K Street, N.W.; Suite 1000
Washington, D.C. 20006
(202) 659-2930



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PATENT TRADEMARK OFFICE

^{3/} See, lines 1 and 2, page 4 of the outstanding Action.